ENERGY AND SUSTAINABLE DESIGN UNIT

OFFICE OF DESIGN AND ENGINEERING

U.S. DEPARTMENT OF STATE
BUREAU OF OVERSEAS BUILDINGS OPERATIONS

GREENING DIPLOMACY INITATIVE MISSION

*"It's a pledge that we will take to improve the **environmental impact of our operations here and abroad**…I think we can set a real example…This should be a global effort, where we all try to have the symbols of our national presence in each country **represent the best technology that any of us can put together in retrofitting buildings** and building new buildings, and then personally doing what each of us can do to make our contribution."*

~ Secretary Clinton,
Earth Day address
April 2009

GDI
GREENING DIPLOMACY INITIATIVE
UNITED STATES DEPARTMENT OF STATE

GREENING DIPLOMACY INITATIVE LEADING BY EXAMPLE

The Greening Diplomacy Initiative (GDI) was launched by Secretary Clinton on April 22, 2009 to improve the environmental performance and sustainability of the State Department's world-wide facilities and operations, including:

- Facilitate Department-wide sustainability policies
- Hear and facilitate action on employee ideas
- Implement a communications strategy
- Review progress of ongoing greening efforts
- Provide a forum for exchanging lessons learned

GDI GREENING COUNCIL:: 2011

ABOUT THE PROGRAM GUIDING PRINCIPLES

The Energy and Sustainable Design Unit (ESD) guides OBO to comply with sustainable design and energy conservation requirements of federal mandates and policies.

- Guiding Principles:
  - Implementing **best practices** in design, construction, and operation of facilities
  - Leveraging **information technology** to support high performance and efficiencies
  - Minimizing **energy consumption** and increasing cleaner energy use
  - Using **environmentally preferable products** and reducing **waste** streams
  - Protecting and conserving **water**
  - Optimizing **ecosystems** services
  - Enhancing **indoor environmental quality** to support occupant well-being and productivity
  - Advancing U.S. efficient, clean energy and **sustainable technologies** and services

BUILDINGS GREENHOUSE GAS EMISSIONS

The building sector is responsible for 1/3 of global GHG

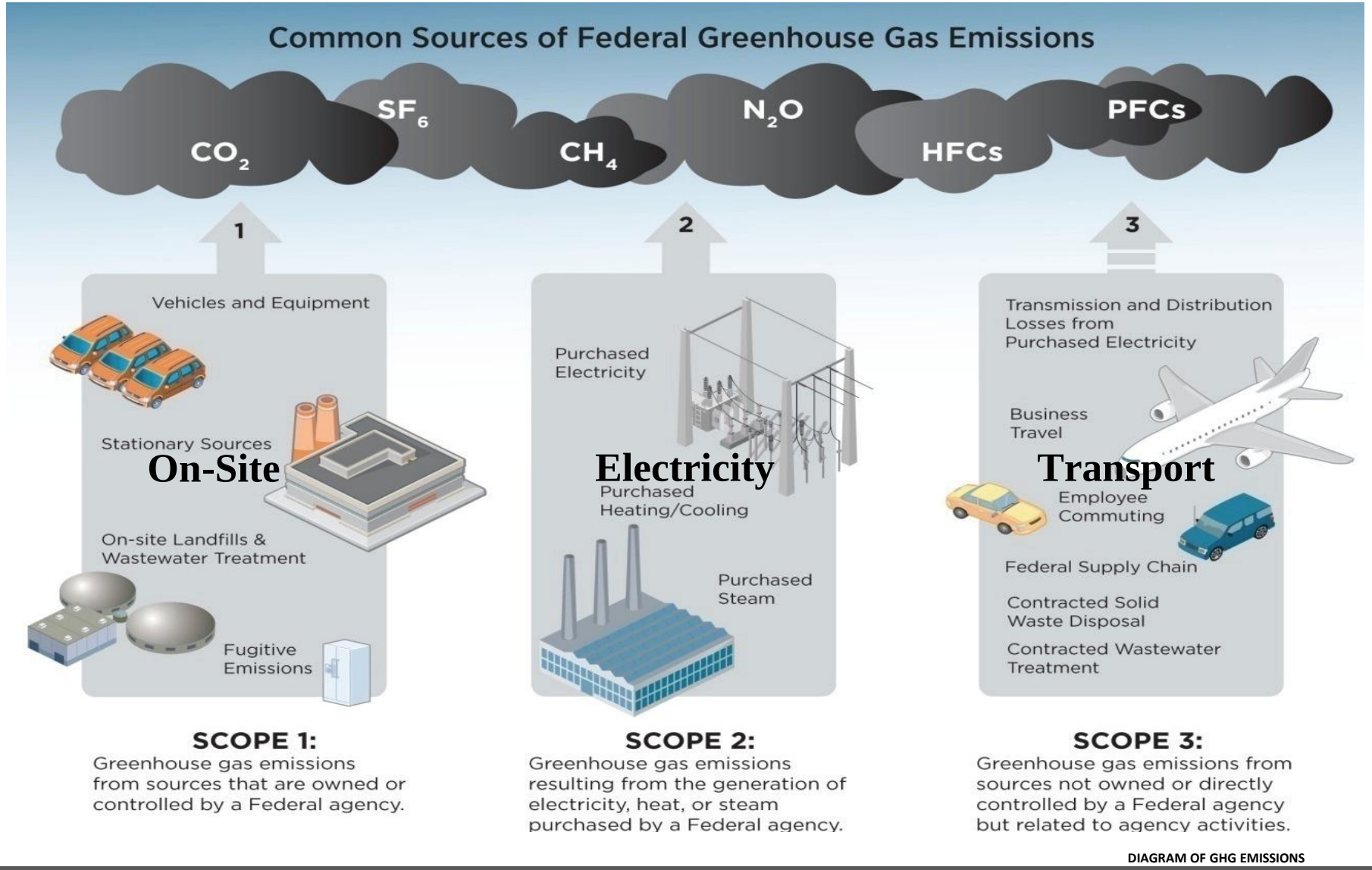
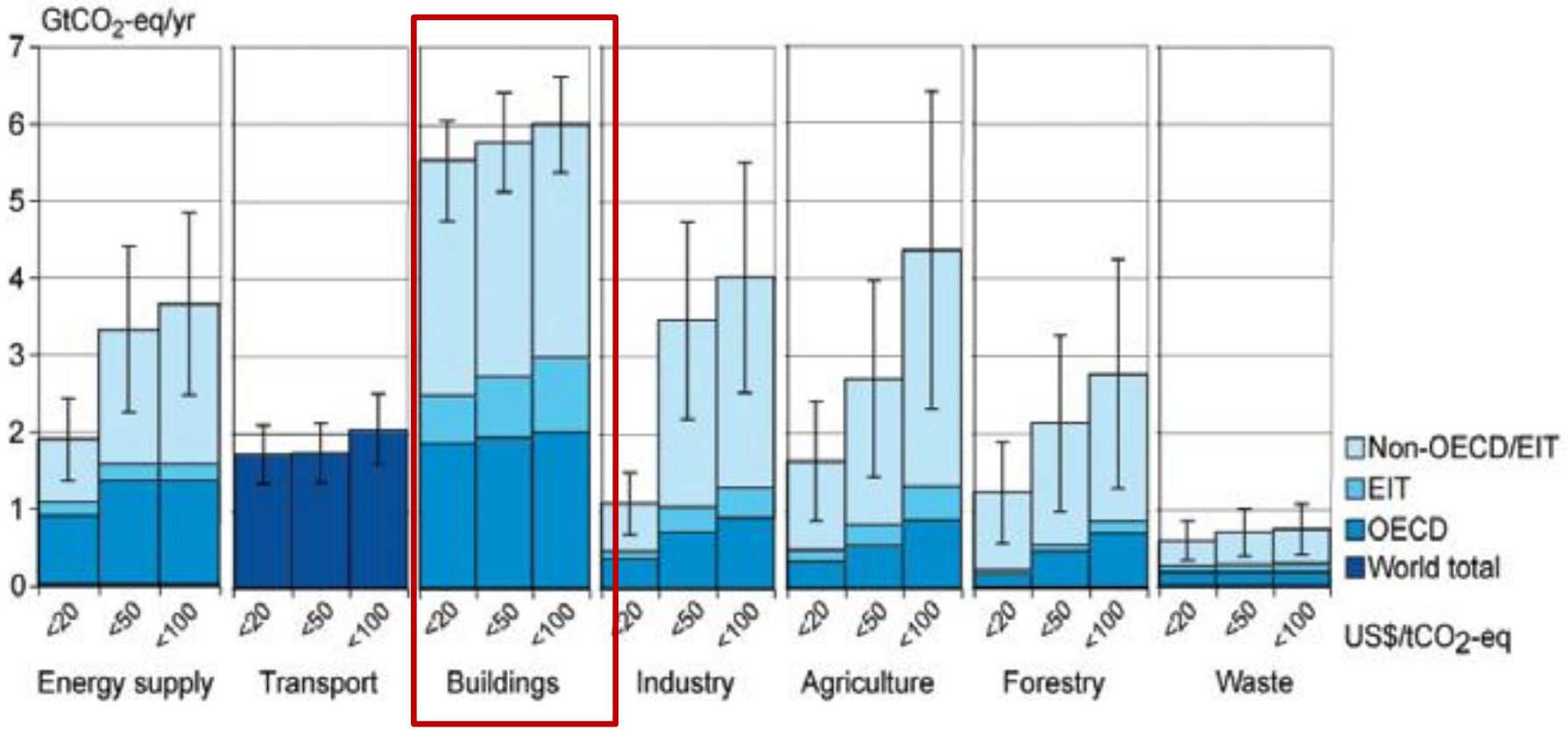


DIAGRAM OF GHG EMISSIONS

BUILDINGS GREENHOUSE GAS EMISSIONS

The <u>building sector</u> has the greatest potential to deliver quick, deep, and cost effective GHG mitigation.



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

FEDERAL MANDATES NEW CONSTRUCTION

Nearly 100 new embassies built in the last decade with another 40 in design or under construction

- Executive Order 13514* (2009)
  - 30% less energy use than ASHRAE 90.1-2007 by 2015
  - 20% less building water use than EPACT 2005
  - 50% less freshwater use for irrigation
  - Divert 50% of construction waste

- Energy Independence & Security Act (2007)
  - Net Zero energy consumption in New Construction by 2030

U.S. EMBASSY PORT AU PRINCE, HAITI :: 2006

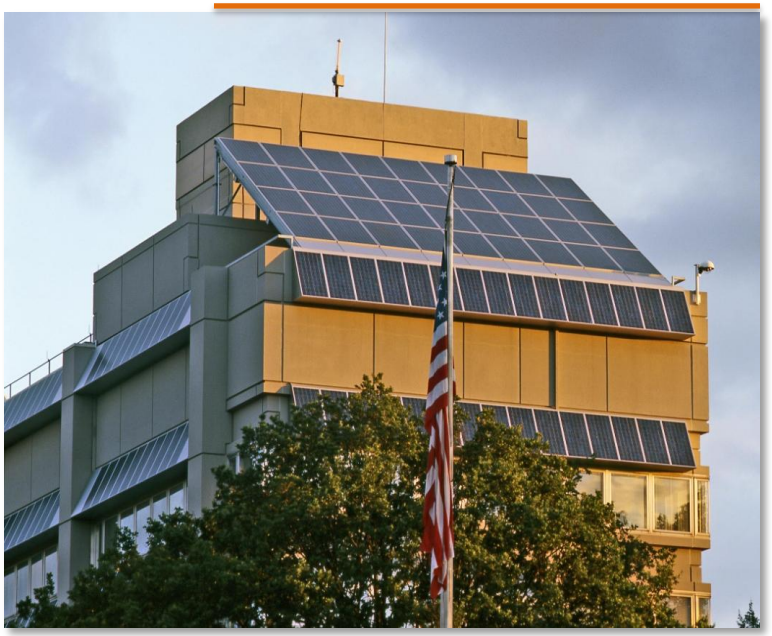
**Limited to domestic facilities, except as implemented overseas in accordance with the policy set forth in Section 1 of EO 13514 and EO 13423.*

FEDERAL MANDATES EXISTING BUILDINGS

The Department of State occupies ~19,000 buildings overseas

- Executive Order 13514* (2009):
  - 30% Energy reduction from 2006 levels by 2015
  - 26% Building water reduction from 2007 levels by 2020
  - 20% Irrigation water reduction from 2010 levels by 2020
  - Divert 50% of non-hazardous solid waste by 2015
  - Report Greenhouse Gas Emissions
- Energy Policy Act (2005):
  - 7.5% Renewable Energy by 2013
  - Building Metering by 2012
- Executive Order 13423* (2006):
  - 15% of Agency Real Property Assets be Sustainable by 2015

**Limited to domestic facilities, except as implemented overseas in accordance with the policy set forth in Section 1 of EO 13514 and EO 13423.*



U.S. EMBASSY GENEVA, SWITZERLAND :: 1998

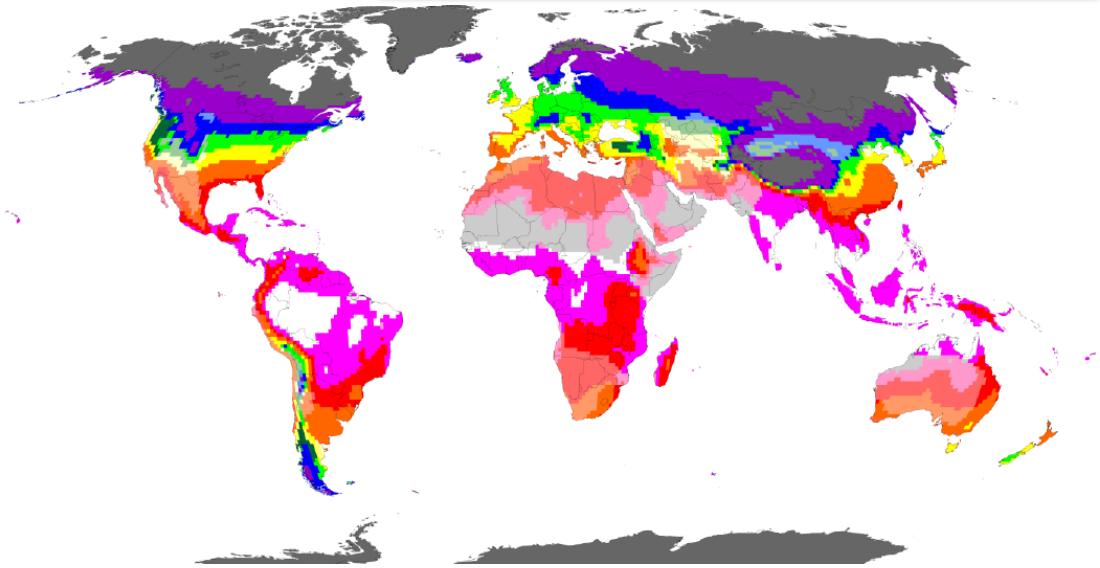
OVERSEAS BUILDINGS PORTFOLIO

The Department operates 275 missions

- 70,000,000 square feet
- 5,300 artworks
- 12,200 culturally significant properties
- $4.5 billion currently under design and construction

  - Embassies
  - Consulates
  - Shops
  - Warehouses
  - Office and Support Annexes
  - Cultural Heritage Properties
  - Housing

International Climate Zones

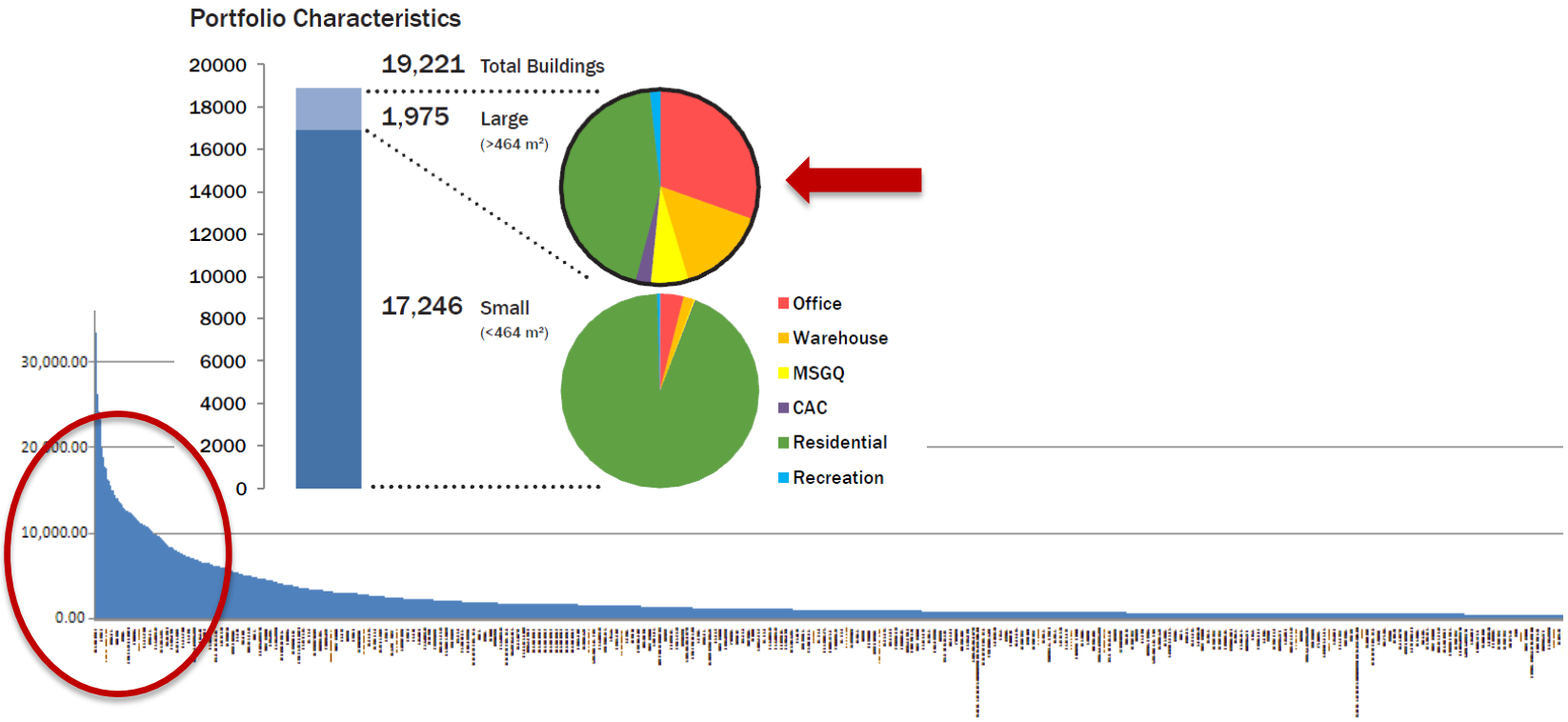


SOURCE: ASHRAE 169 :: 2012

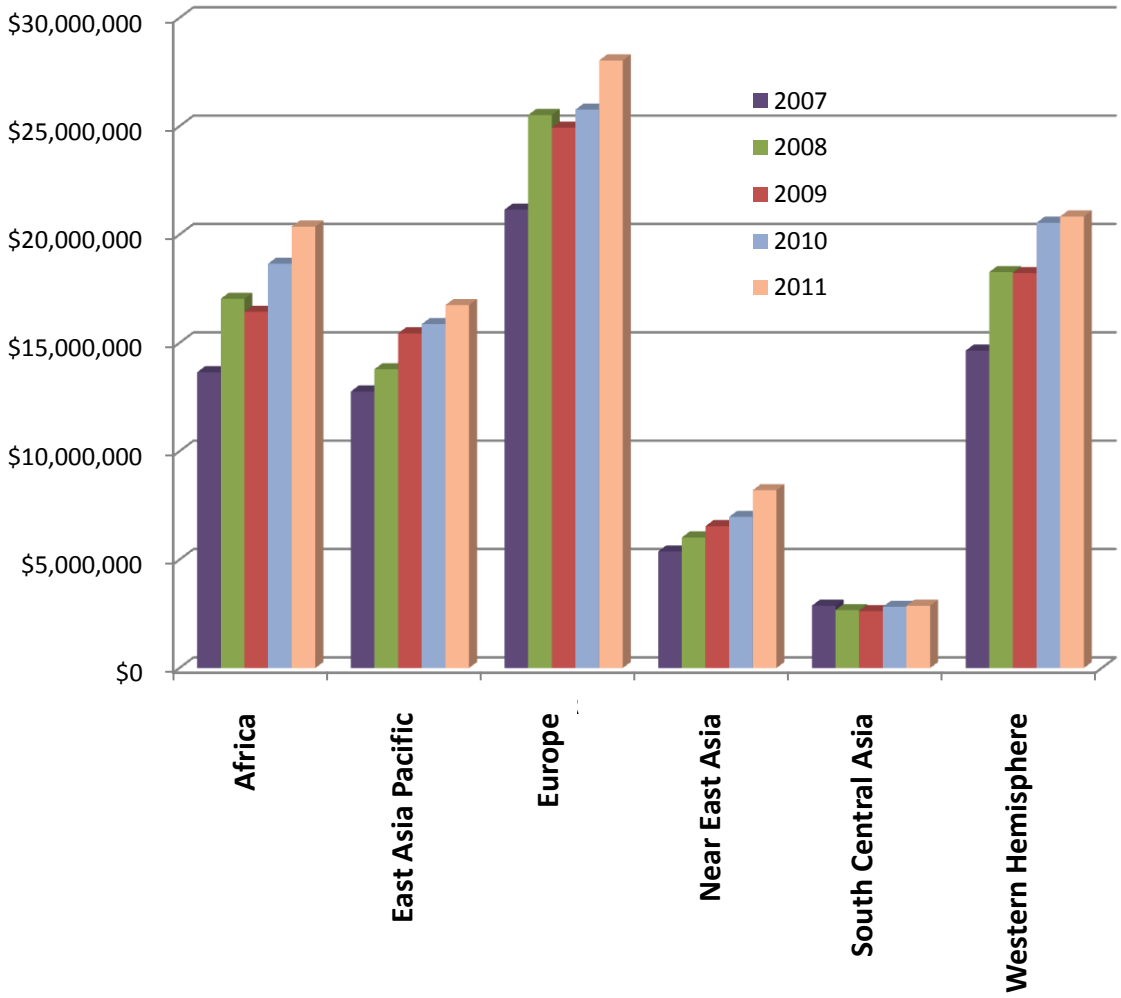
OVERSEAS BUILDINGS PORTFOLIO

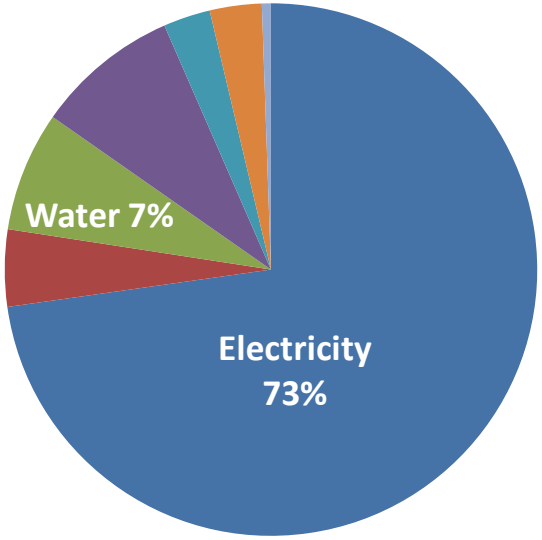
Department of State occupies ~19,000 buildings overseas

- **2,000** over 5,000gsf
- **3,052** owned (2,083 residences)
- **107** long-term leases (64 residences)
- **15,415** short-term leases (14,602 residences)



Regional Bureau Electricity Costs: 2007-2011





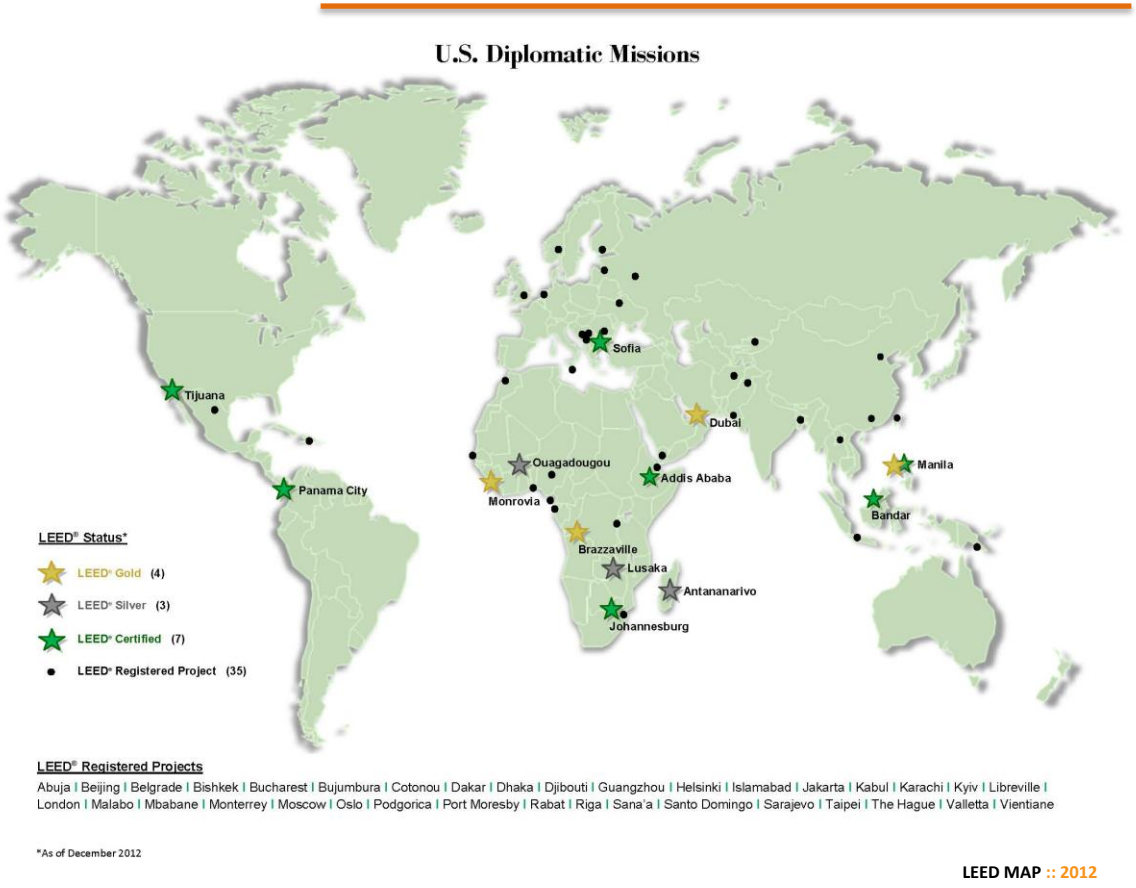
%	Utility Type
72.75%	Electricity
4.67%	Gas
7.28%	Water
8.74%	Diesel
2.85%	Dist. Heat & Cool
3.16%	Trash
0.55%	Sewage

SOURCE: DOS GLOBAL FINANCIAL MANAGEMENT SYSTEM :: 2012

OVERSEAS BUILDINGS BENCHMARKING PERFORMANCE

To date, fourteen embassies and consulates have been certified by the U.S. Green Building Council earning the principles and requirements of Leadership in Energy and Environmental Design (LEED®). Additionally, OBO has over thirty buildings in the pipeline for LEED certification.

- These buildings are modeled to:
  - Reduce energy costs by an average of 20%
  - Reduce building water use by 37%
  - Reduce site irrigation water by 76% below baselines



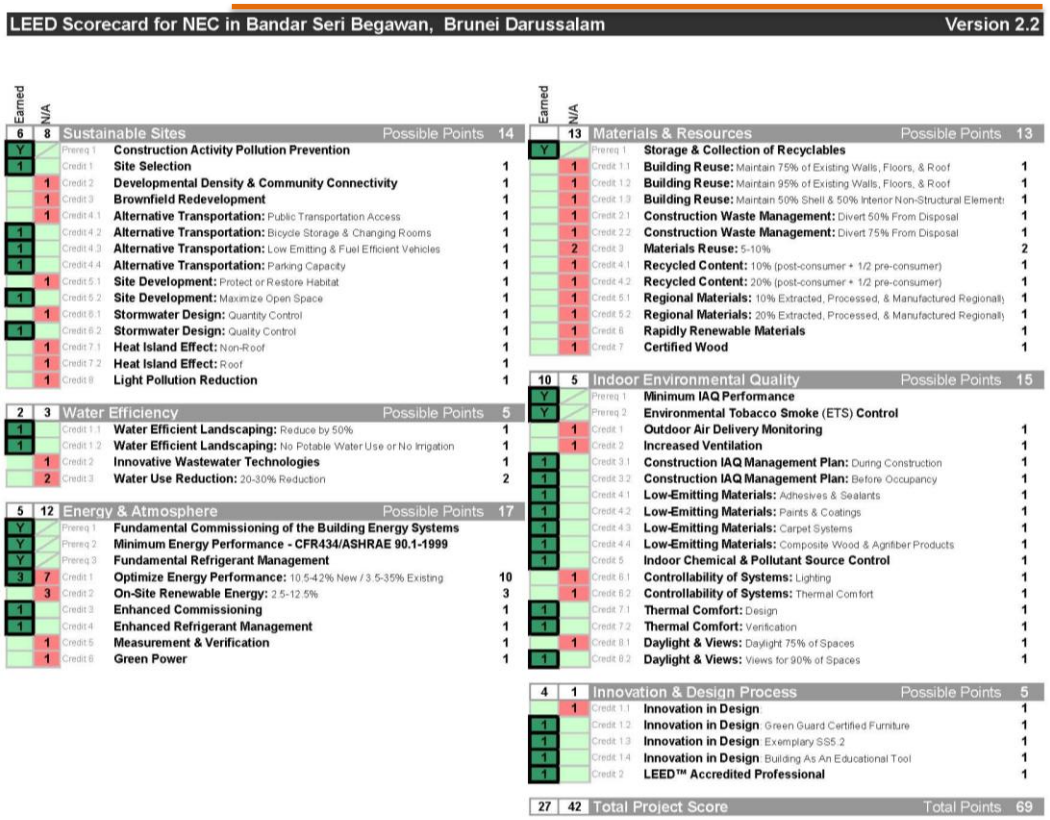
LEED MAP :: 2012

OVERSEAS BUILDINGS LEED SCORECARD

The LEED® scorecard is for a contractor, owner or architect to use as a guide during the LEED certification process. As the design team incorporates the LEED requirements into the construction documents, expected credits can be tracked to see where the project stands.

The LEED Scorecard contains 6 categories:

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Design
- Regional Priority Credits



LEED Scorecard for NEC in Bandar Seri Begawan, Brunei Darussalam — Version 2.2

Earned	N/A	Sustainable Sites — Possible Points 14	
Y		Prereq 1	Construction Activity Pollution Prevention
1		Credit 1	Site Selection 1
	1	Credit 2	Developmental Density & Community Connectivity 1
	1	Credit 3	Brownfield Redevelopment 1
	1	Credit 4.1	Alternative Transportation: Public Transportation Access 1
1		Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms 1
1		Credit 4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles 1
1		Credit 4.4	Alternative Transportation: Parking Capacity 1
	1	Credit 5.1	Site Development: Protect or Restore Habitat 1
1		Credit 5.2	Site Development: Maximize Open Space 1
	1	Credit 6.1	Stormwater Design: Quantity Control 1
1		Credit 6.2	Stormwater Design: Quality Control 1
	1	Credit 7.1	Heat Island Effect: Non-Roof 1
	1	Credit 7.2	Heat Island Effect: Roof 1
	1	Credit 8	Light Pollution Reduction 1

Earned	N/A	Water Efficiency — Possible Points 5	
1		Credit 1.1	Water Efficient Landscaping: Reduce by 50% 1
1		Credit 1.2	Water Efficient Landscaping: No Potable Water Use or No Irrigation 1
	1	Credit 2	Innovative Wastewater Technologies 1
	2	Credit 3	Water Use Reduction: 20-30% Reduction 2

Earned	N/A	Energy & Atmosphere — Possible Points 17	
Y		Prereq 1	Fundamental Commissioning of the Building Energy Systems
Y		Prereq 2	Minimum Energy Performance - CFR434/ASHRAE 90.1-1999
Y		Prereq 3	Fundamental Refrigerant Management
3	7	Credit 1	Optimize Energy Performance: 10.5-42% New / 3.5-35% Existing 10
	3	Credit 2	On-Site Renewable Energy: 2.5-12.5% 3
1		Credit 3	Enhanced Commissioning 1
1		Credit 4	Enhanced Refrigerant Management 1
	1	Credit 5	Measurement & Verification 1
	1	Credit 6	Green Power 1

Earned	N/A	Materials & Resources — Possible Points 13	
Y		Prereq 1	Storage & Collection of Recyclables
	1	Credit 1.1	Building Reuse: Maintain 75% of Existing Walls, Floors, & Roof 1
	1	Credit 1.2	Building Reuse: Maintain 95% of Existing Walls, Floors, & Roof 1
	1	Credit 1.3	Building Reuse: Maintain 50% Shell & 50% Interior Non-Structural Element 1
	1	Credit 2.1	Construction Waste Management: Divert 50% From Disposal 1
	1	Credit 2.2	Construction Waste Management: Divert 75% From Disposal 1
	2	Credit 3	Materials Reuse: 5-10% 2
	1	Credit 4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer) 1
	1	Credit 4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer) 1
	1	Credit 5.1	Regional Materials: 10% Extracted, Processed, & Manufactured Regionally 1
	1	Credit 5.2	Regional Materials: 20% Extracted, Processed, & Manufactured Regionally 1
	1	Credit 6	Rapidly Renewable Materials 1
	1	Credit 7	Certified Wood 1

Earned	N/A	Indoor Environmental Quality — Possible Points 15	
Y		Prereq 1	Minimum IAQ Performance
Y		Prereq 2	Environmental Tobacco Smoke (ETS) Control
	1	Credit 1	Outdoor Air Delivery Monitoring 1
	1	Credit 2	Increased Ventilation 1
1		Credit 3.1	Construction IAQ Management Plan: During Construction 1
1		Credit 3.2	Construction IAQ Management Plan: Before Occupancy 1
1		Credit 4.1	Low-Emitting Materials: Adhesives & Sealants 1
1		Credit 4.2	Low-Emitting Materials: Paints & Coatings 1
1		Credit 4.3	Low-Emitting Materials: Carpet Systems 1
1		Credit 4.4	Low-Emitting Materials: Composite Wood & Agrifiber Products 1
1		Credit 5	Indoor Chemical & Pollutant Source Control 1
	1	Credit 6.1	Controllability of Systems: Lighting 1
	1	Credit 6.2	Controllability of Systems: Thermal Comfort 1
1		Credit 7.1	Thermal Comfort: Design 1
1		Credit 7.2	Thermal Comfort: Verification 1
	1	Credit 8.1	Daylight & Views: Daylight 75% of Spaces 1
1		Credit 8.2	Daylight & Views: Views for 90% of Spaces 1

Earned	N/A	Innovation & Design Process — Possible Points 5	
	1	Credit 1.1	Innovation in Design 1
1		Credit 1.2	Innovation in Design: Green Guard Certified Furniture 1
1		Credit 1.3	Innovation in Design: Exemplary SS5.2 1
1		Credit 1.4	Innovation in Design: Building As An Educational Tool 1
1		Credit 2	LEED™ Accredited Professional 1

27	42	Total Project Score	Total Points 69

LEED SCORECARD FOR BANDAR, BRUNEI DARUSSALAM :: 2012

ENERGY PHOTOVOLTAICS

OBO has been proactive in increasing its portfolio of renewable energy sources, recently installing or in the process of designing photovoltaic (PV) installations at our missions. A total of more than one megawatt of power is currently provided via photovoltaic installations, offsetting reliance on grid-provided and prime-generated power.

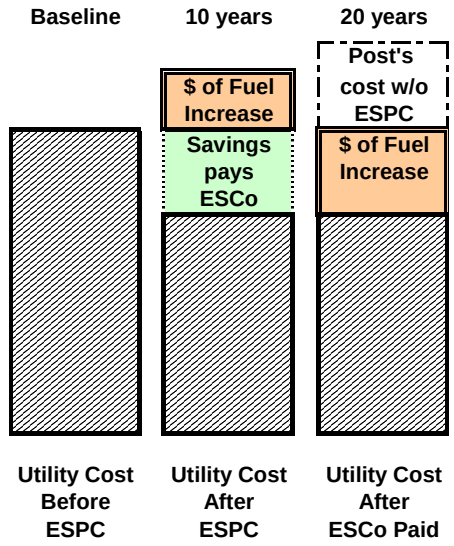
U.S. EMBASSY KIGALI, RWANDA :: 2009

- Benefits:
  - Passive power production with no fuel cost
  - 4–year payback for new construction depending on utility/fuel costs
  - Supplement prime power source –reducing generators in prime plant
  - Reduces electrical source use during peak load
  - Low maintenance
  - Increased security through independence/control of power source

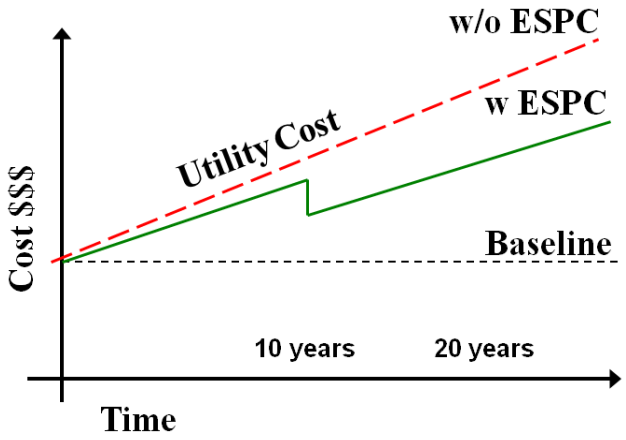
GARAGE MOUNTED PV AT THE U.S. EMBASSY IN ATHENS, GREECE :: 2012

Energy Savings Performance Contracts (ESPC) are a no-upfront-cost contracting method. The contractor incurs the cost of implementing energy conservation measures (ECM) and is paid from the energy, water, wastewater and operations savings resulting from these ECMs.

- Reasons to pursue an ESPC include:
  - Meet energy reduction and environmental goals
  - Fixed price contracts with guarantees
  - Improve facilities comfort, reliability, and interoperability
  - Avoid deferred maintenance and cost of delay and inaction
  - Incentive for ESCO to find all ECMs and provide high quality equipment
  - Incentive for ESCO do all punch list items in a timely manner and complete successful commissioning



PERFORMANCE CONTRACT BENEFITS



LIFETIME SAVING DIAGRAM

Solar water heating is a well proven source of renewable energy with steadily increasing efficiency and worldwide installations. Energy rates in many places around the world are already high and continue to rise. Solar Water Heating offers increased energy security through reduced dependence on local energy providers.

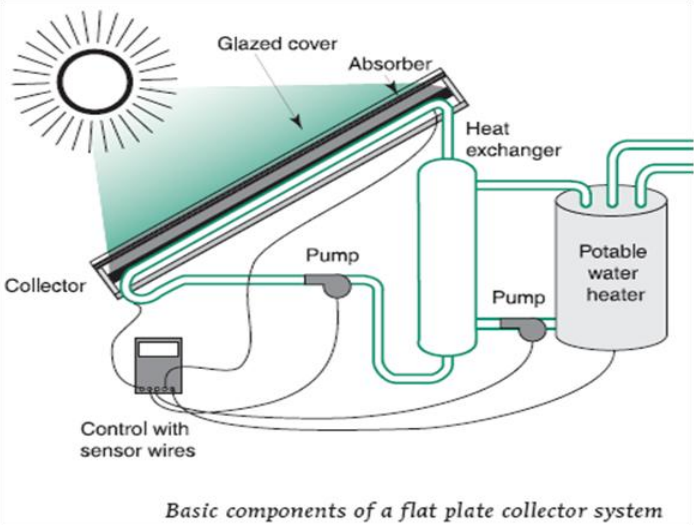


DIAGRAM OF SOLAR HOT WATER HEATER

- Benefits:
  - Produce power quietly with no green-house gas emissions, thus reducing the carbon footprint of the facility
  - Perform for long periods with little maintenance
  - Reduce utility costs as well as maintenance and repairs, due to no/few moving parts
  - Function well in almost any climate
  - Require no heavy construction equipment

SOLAR HOT WATER HEATER ON DIPLOMATIC RESIDENCE IN SAN SALVADOR :: 2012

The MagLev (for magnetic levitation) chiller substitutes a magnetic field for the ball bearings.

- Benefits:
  - Reduces Power Usage – 0.5 kW/ton of cooling
  - Lowers Maintenance – oil free magnetic bearings
  - Eliminates Cooling Tower
  - Reduces generator size and fuel consumed
  - Modules can be added to match increasing load
  - Minimizes production during low demand and subsequently low energy usage
  - Low noise, frictionless bearings, variable frequency drive, and permanent magnet rotors

MAGLEV CHILLERS IN TOKYO, JAPAN :: 2012

MODULAR CHILLER IN FREETOWN, SIERRA LEONE :: 2012

ENERGY WIND

Wind is a well proven source of renewable energy, with steadily increasing efficiency and worldwide installations. OBO has produced a Wind Study Report to evaluate the feasibility of wind generated power at U.S. mission facilities. For larger turbines projects, OBO uses Sonic Detector and Ranging (SODAR) technology to measure wind speed, direction, and shear.

WIND TURBINE

- Three important factors must be considered for wind power:
  - Annual mean wind speed - An average annual wind speed of 6.0 meters/second is desirable
  - Electrical utility rate – An average annual utility rate of .15/kWh or above
  - Location on site – Large expansive sites are ideal for wind power, while small urban sites are not

SODAR EQUIPMENT IN NOUAKCHOTT, MAURITANIA :: 2011

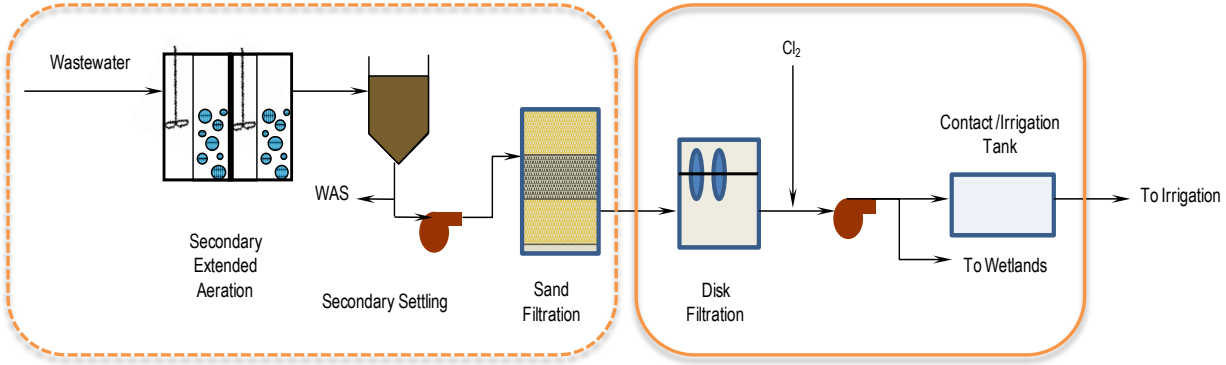
WATER AUDITS

To optimize water use at existing facilities, OBO conducts comprehensive water audits at posts with high water use or at posts experiencing water shortages.

The audit at the U.S. Embassy in Nairobi, Kenya indicated the following:

- Reuse 3.8M liters/yr of treated wastewater reduces irrigation demands on local aquifer
- Redesign of planting & irrigation systems would conserve 8.3M liters/yr
- Use of constructed wetland clarifies treated wastewater for discharge

CONSTRUCTED WETLANDS AT U.S. EMBASSY NAIROBI, KENYA :: 2011



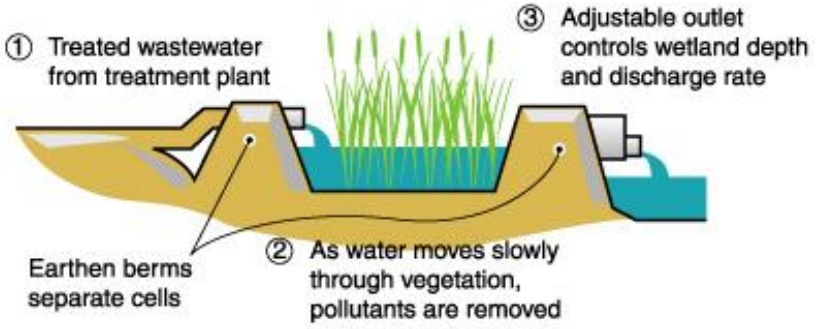
SOURCE: CH2M HILL :: 2011

WATER IRRIGATION

Irrigation water needs are reduced by practicing xeriscaping—the specification of native and adapted plant species—to the extent possible, by grouping like plantings together, and by providing metered and programmable drip irrigation with rainwater sensors.

- Irrigation Efficiency
  - Native, drought tolerant plants and in-ground drip irrigation systems
- Treated Wastewater Effluent Reused
  - Use of cleansed wastewater for irrigation allows for zero potable water use for irrigation
- Constructed Wetlands
  - Cleaned water from constructed wetlands can be reused for irrigation

U.S. EMBASSY KAMPALA, UGANDA :: 2000



CONSTRUCTED WETLANDS DIAGRAM

WATER RAIN WATER HARVESTING

OBO addresses storm water management in its standard requirements and is developing rainwater harvesting strategies where practical to do so.

- U.S. Consulate Abu Dhabi
  - The roof design cascades rainwater down into the constructed wetland
- U.S. Embassy Monrovia
  - Receives over 200 inches/year of rainfall
  - First time use of rainwater for 100% of embassy demand
  - Maximize water use efficiency
  - Optimize rainwater collection tank size

U.S. EMBASSY ABU DHABI, UNITED ARAB EMIRATES :: 2004

U.S. EMBASSY MONROVIA, LIBERIA :: 2012

WATER PLUMBING FIXTURES

Indoor water strategies can effectively reduce the water consumption at a facility. OBO incorporates water-saving fixtures into new facilities and supports posts with a replacement program for older, more water-intensive plumbing fixtures in facilities that demonstrate high consumption and high cost.

LOW-FLOW PLUMBING FIXTURE

- Indoor strategies include:
  - Air-cooled chillers rather than water-cooled chillers to substantially reduce water use in air conditioning systems;
  - Low-flow and automatic-shutoff plumbing fixtures to reduce building water use
  - WaterSense Fixtures including dual flush toilets, faucet aerators, and waterless urinals

WATERLESS URINAL

2012 - OBO Enters a New Era of Design Excellence

- Guiding Principles:
  - Purpose & Function
  - Site
  - Design & Engineering
  - Safety & Security
  - Sustainability
  - Architecture
  - Construction
  - Operations & Maintenance
  - Art
  - Historically, Architecturally, or Culturally Significant Properties and Collections
- Sustainability Stretch Goals:
  - Net-Zero-Carbon, -Energy, -Water, & -Waste
  - LEED Platinum

U.S. EMBASSY BANDAR SERI DEGAWAN, BRUNEI :: 2012

U.S. EMBASSY NEW DELHI, INDIA :: 2012

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- Energy Project Management
- Photovoltaics & LED
- Energy Savings Performance Contract Program